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ABSTRACT

To determine if performance on short term auditory memory tasks is influenced by reading ability or sex differences, 62 third grade reading students (16 above average boys, 16 above average girls, 16 below average boys, and 14 below average girls) were administered four memory tests--memory for consonant names, memory for words, memory for sentences, and memory for a story. Students listened to tape recorded stimuli and responded orally in each of the tests. Analysis of variance procedures, used to examine differences in mean scores of reading groups and sex groups, revealed that above average readers were superior to below average readers at a significant level on all four memory tests. Results revealed only random differences, however, between mean scores of boys and girls and indicated no significant interaction between the sex factor and the reading group variable. (Extensive appendixes of test instruments and results are included. (Author/MM)

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SHORT-TERM AUDITORY MEMORY OF ABOVE-AVERAGE AND BELOW-AVERAGE GRADE THREE READERS

A Thesis
Submitted to the College of Graduate Studies and Research
in Partial Fulfilment of the Requirements
for the Degree of
Master of Education
in the
Department of Curriculum Studies
College of Education
University of Saskatchewan

by

Joan Marie Caruk

Saskatoon, Saskatchewan

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ABSTRACT

The purpose of the present study was to examine the ability of above-average and below-average grade three readers to perform four tasks of short-term auditory memory, and to ascertain whether differences exist in girls' and boys' performances. One hundred and twenty children from five grade three classes were screened by means of a cloze test to identify reading levels. Sixty-two children were individually administered four tests of short-term auditory memory: 16 above-average boys, 16 above-average girls, 16 below-average boys, and 14 below-average girls. The names of the tests used were Memory for Consonant Names, Memory for Words, Memory for Sentences, and Memory for a Story. Each child listened to tape recorded stimuli and responded orally.

Analysis of variance (ANOVA) procedures were used to examine differences between mean scores of reading groups and sex groups on four tests of short-term auditory memory. Above-average readers were superior to the below-average readers at a significant level on all four memory tests. Only random differences between mean scores of girls and boys were found for all four tests. No significant interaction between the sex factor and the reading group factor was evident.

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Especially, I wish to express my gratitude to Harry, my husband.

DEDICATION

To

Laurel and Aaron

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Chapter I

INTRODUCTION TO THE STUDY

The Problem

The purpose of this study was to examine the ability of above-average and below-average grade three readers to perform four tasks of short-term auditory memory, and to compare sex differences between and across groups. The four auditory memory tests were Memory for Consonant Names, Memory for Words, Memory for Sentences, and Memory for a Story. The stimuli of the four tests were similar to stimuli encountered in the reading process, that is, letters, words, sentences, and a story.

The investigation sought to answer two main questions:

1. Are there any differences in performance of above-average and below-average grade three readers on short-term auditory memory tasks?

2. Are there any differences in performance of grade three girls and grade three boys on short-term auditory memory tasks?

Background and Need for the Study

Teachers recognize the powerful role memory plays in learning and that sharp differences exist in students' memory skills. McGaugh (1973) confirms these feelings about the importance of memory:

> Memory is clearly one of the most important capacities of man and the other animals. It is through memory that experiences of the past influence our present thoughts, plans, and actions. Without memory, of course, we would be unable to learn. It is

> difficult to imagine a human being lacking the ability to record experiences. Some signs of memory are usually seen even in the most severe cases of mental retardation. (p. 34)

Although classroom teachers complain about the amount of forgetting that they are convinced occurs day-to-day, they should be impressed by the amount of memory each child possesses and to which they (the teachers) are always adding. Hunt (1982) stresses the positive:

> And indeed most of us, when we think about memory, do so chiefly in a negative context. If memory works well, we take it for granted, as we do breathing; we notice it only when it fails us. But the attitude of most cognitive scientists is very different: they are deeply impressed by, and respectful of, what they have been discovering about both the size and the efficiency of the human memory system. (pp. 84-85)

There have been various estimates of the lifetime capacity, or size, of the average human memory. Jon von Neumann calculates 280 quintillion (2.8×10^{20}) bits, assuming that nothing is ever truly forgotten (Hunt, 1982). Even if one remembered only a thousandth of this amount in a lifetime, an active human memory would still store "several billion [author's emphasis] times more information than a large contemporary research computer" (Hunt, 1982, p. 85).

The impressive capacity of memory is one of many topics of memory research. Between 1960 and 1970, the number of publications relating to memory increased almost sixfold and continues to grow (Tulving & Donaldson, 1972). Some of the major areas of study include: the organization of memory; how to measure memory; how to improve memory; and memory as it relates to the cognitive skills.

Tulving (1972) stresses the intricate relationship of memory with perception, motivation, emotions, thinking, and learning. If one agrees that memory is essential to learning (Bartlett, 1958; Leddy, 1960;

Maccoby & Jacklin, 1974; McGaugh, 1973; Smith, 1975), then one must also agree that memory is essential to reading (Ekwall, 1976; Smith, 1975; Torgeson, 1977). Alexander (1979) summarizes:

> The reader must recall what he reads as well as his own experiences and other relevant readings; altogether, these factors result in comprehension, expanding the meaning the reader is able to take from what he reads. (p. 136)

This study sought to examine one fragment of the memory process and its relationship to the reading ability of grade three boys and girls.

Definition of Terms Used

For the purpose of this study, certain definitions have been adapted from the literature and the sources identified.

Above-Average Readers (R+) - Children whose cloze scores were above the median score of the total group screened.

Below-Average Readers (R-) - Children whose cloze scores were below the median score of the total group screened.

Cloze Test - A reading test consisting of a passage, or passages, in which every fifth word is replaced by a blank space of uniform length.

Exact Cloze Score - The number of responses made by the reader in which the word supplied is the deleted word (Gallant, 1965).

Memory - Retrieval of past impressions and experiences, as through retention, recall, recognition, and learning (Harris & Hodges, 1981).

Short-Term Memory - Limited capacity memory of short duration which dissipates with time or is replaced by new information (Bush & Andrews, 1980).

Short-Term Auditory Memory - Short-term memory which receives stimuli via the auditory buffer.

Recall Task - A test of what is remembered in the absence of stimuli following one presentation of stimuli (Perlmutter & Lange, 1978).

Free Recall - Stimuli may be recalled in any order (Perlmutter & Lange, 1978).

Limitations of the Study

The children who participated in this study were grade three Saskatoon Catholic School students, screened to have IQ scores between 85 and 115, who had not repeated a grade, had not accelerated, and who spoke English as their first language. Generalization of results of this study, therefore, is restricted to other similar populations.

Hypotheses

The following set of null hypotheses were tested using the .05 level of significance:

1. There will be no difference in performance between above-average readers and below-average readers on Memory for Consonant Names.

2. There will be no difference in performance between above-average readers and below-average readers on Memory for Words.

3. There will be no difference in performance between above-average readers and below-average readers on Memory for Sentences.

4. There will be no difference in performance between above-average readers and below-average readers on Memory for a Story.

5. There will be no difference in performance between girls and boys on Memory for Consonant Names.

6. There will be no difference in performance between girls and boys on Memory for Words.

7. There will be no difference in performance between girls and boys on Memory for Sentences.

8. There will be no difference in performance between girls and boys on Memory for a Story.

Chapter II

SELECTED REVIEW OF THE LITERATURE

This review of the literature examined four areas of research which concern the present study: 1) short-term auditory memory in relation to total memory process; 2) memory and reading ability; 3) sex differences in memory ability and in reading ability; and 4) cloze procedure as a measure of reading ability.

Short-Term Auditory Memory in Relation to Total Memory Process

Overview of Memory

Complex was the word most frequently used to describe memory in the literature. For example, Perlmutter and Lange (1978) report more than 50 labels of categories of memory being researched in education and psychology. In order to limit the discussion, this section of the chapter begins with the total memory process and then considers short-term auditory memory--the focus of this study.

Smith (1975) relates three ways one can view memory: 1) the place in which information is stored; 2) the content of such a store; or 3) the process which enables one to remember. There is necessarily a degree of overlap among the three views and one view alone fails to explain the entire phenomenon of memory. Though viewing memory as a process helps to explain some of its dynamic characteristics (Smith, 1975), the

difficulty lies in understanding how the process operates (Wood, 1972).

Smith (1975) further breaks down the mental process of memory to include "selection, acquisition, retention, organization, retrieval, reconstruction and utilization of all our knowledge and beliefs about the world, including our past experience" (p. 65). All these in combination constitute the interactive process of memory. It is fair to conclude that memory is actively and intricately related to all components of the thinking process (Hunt, 1982; Leddy, 1960; Maccoby & Jacklin, 1974; Smith, 1975; Tulving, 1972; Young, 1978).

Memory is always active, in terms of the present and the future. Thus it is affected by, as well as dependent on, past knowledge and experience (Bartlett, 1958; Fleming & Ohnmacht, 1977; Hunt, 1982; Perlmutter & Lange, 1978; Smith, 1975). Researchers discuss the previous knowledge and experience held in memory under several names: data base, knowledge base, or permanent memory. Young (1978) describes a knowledge base as:

> . . . something that is constructed and grows, the result of a unique series of experiences and actions from conception onwards. It can be added to, but never wholly remade. Indeed its very existence is only possible as part of that program of events we call a lifetime. (p. 79)

Hence, no two people mentally process memory the same because of the uniqueness of their already existing memory, and the way they perceive the world. In addition, what is recommended is what one needs and wants to remember (Russell, 1956). Bower (1972) adds that what one remembers are only interpretations of events in the world. These interpretations depend on stimulus events as well as "subjective factors such as our attitude, and our expectation or mental set established by the prior psychological context" (pp. 93-94).

Memory Model

Various models have been created to conceptualize the complicated process of memory (Naus, Orstein, & Hoving, 1978; Perlmutter & Lange, 1978; Wood, 1972). The multistore model (Atkinson & Shiffrin, 1968) seems to most appropriately represent short-term auditory memory as measured by this study.

The multistore model theorizes that the brain performs sets of transformations on the information it perceives via the senses. Depending on the stage of transformation it reaches, the information will be retained anywhere from a fraction of a second to permanently. Hunt (1982) refers to multistore as the Information Processing (IP) model, and discusses at length why its representation of the system of processes of human memory is a superior model.

The multistore model views the memory process as having three main stages: 1) sensory register; 2) short-term memory; and 3) long-term memory (Gilmartin, Newell, & Simon, 1975; Orstein, 1978; Smith, 1975). Smith (1975) differentiates the three stages of transformation through which information may pass. The sensory register experiences stimuli from the environment through one of five sensory registers. In the auditory register, the stimuli can "echo" for several seconds while the brain decides whether to process the information further or allow it to decay. If it is to be processed further, it becomes a part of short-term memory. Short-term memory serves as a "working memory" for transient information, storing it for up to several minutes. In short-term memory, as in sensory register, the brain faces a choice: either forget the information or process it further. The choices are not necessarily always conscious.

Figure 2.1 represents the adaptation and combination of two flow charts of the multistore model of memory (Gilmartin, Newell, & Simon, 1975; Hunt, 1982). The chart conceptualizes the links of the human memory system and demonstrates the relation of short-term auditory memory to the total system.

Short-Term Memory

Definition. In the Dictionary of Reading and Learning Disability, short-term memory is defined as "limited capacity memory of short duration which dissipates with time or is replaced by new information" (Bush & Andrews, 1980, p. 80). Smith (1975), who refers to short-term memory as working memory, agrees that it lasts only briefly, several minutes at the most. Information in short-term memory has been processed just deeply enough to be active mental activity and can be held only as long as there is conscious thinking. When thinking stops, the information rapidly dissipates from the memory system. If one is able to later retrieve the information, it is because it was processed further into long-term memory (Hunt, 1982).

Measurement. The method most frequently used to test short-term memory is to ask subjects to speak or write a response immediately following presentation of stimuli (Tarpy & Mayer, 1978). Tests can be classified as either a measure of recognition or recall, depending on the conditions under which the subject responds. If the stimulus is present when the response is made, e.g., answering a multiple choice question, it is a measure of recognition. On the other hand, if a subject is expected to respond in the absence of stimuli, it is referred to as a measure of recall (Perlmutter & Lange, 1978). This study depends on recall which will be discussed further.

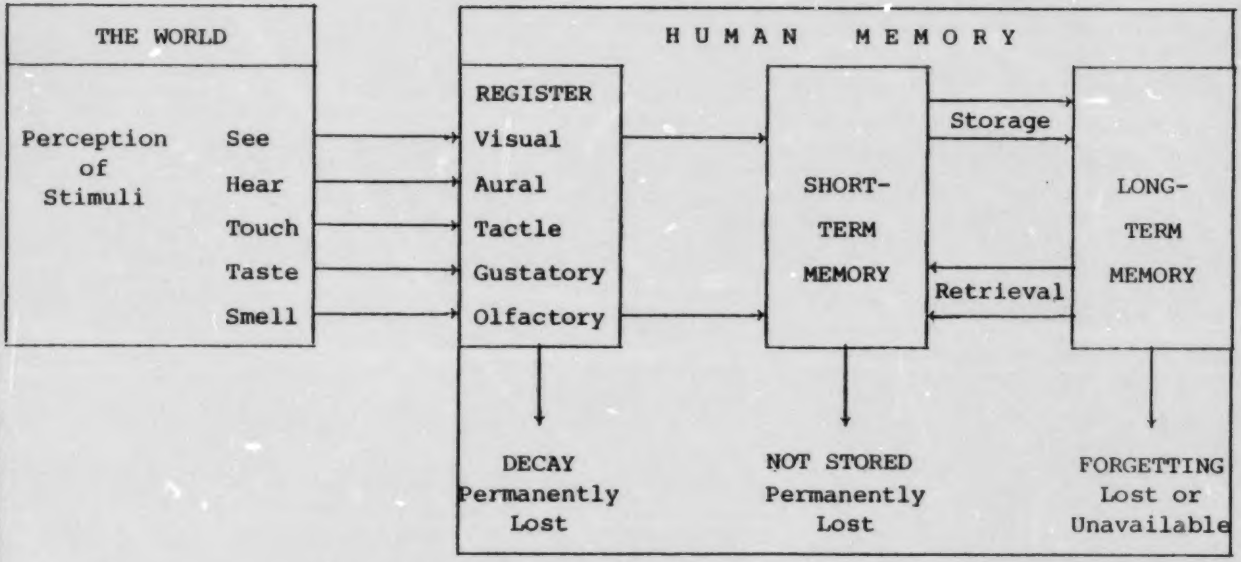


Figure 2.1 Flow chart of the multistore model of the human memory system (After Gilmartin, Newell, & Simon, 1968; Hunt, 1982)

Recall is direct evidence that memory is working (Robeck & Wilson, 1974). Recall employs a variety of efficient mechanisms to deliberately retrieve information (Hunt, 1982). One important advantage of measuring short-term memory by recall is that guessing is not possible as it would be with recognition. Moreover, pertinent to this study, McGaugh (1973) suggests that recall is the more complicated memory process subject to greater forgetting.

Limited capacity. Short-term memory is severely limited in the amount of new and unrelated information it is able to retain while deciding what to do with it (Smith, 1975). From experiments in the 1950s, it was determined that on the average an adult can retain and recall seven items of information. The term "item" is synonymous with that of "unit", or "chunk". One item (one unit, or one chunk) could be any of the following: 1) a number, e.g., 6; 2) a letter, e.g., m; 3) a word, e.g., horse; 4) a familiar phrase, e.g., ice cream cone; 5) a familiar date, e.g., 1867; or 6) a familiar sentence, e.g., A stitch in time saves nine (Hunt, 1982; McGaugh, 1973).

There is variation in ability, of course, but numerous researchers verify that the majority of adults are able to recall seven items, plus or minus two (Hunt, 1982; McGaugh, 1973; Smith, 1975; Wood, 1972). Observe, for example, the range of people's ability to listen to and repeat a seven digit telephone number. In discussing the limited capacity of short-term memory, the literature often refers to "Miller's magic number seven".

Though this may seem a severe restriction to the entire memory process, it can also be viewed as an advantage because it prevents a kind

of sensory overload. If one is swamped with incoming information, one must expend more time and energy to organize, priorize, and make decisions. This implies an active learner, capable of imposing structure on information received (Postman, 1972), as well as a skillful learner who knows what should be ignored (Downing & Leong, 1982).

Age. Research comparing age and memory ability reports consistent findings of age-related improvement, i.e., older children recall more items than younger children (Orstein, 1978; Orstein & Naus, 1978; Raymond, 1954). Recall ability gradually increases until children are approximately ten years old, at which age most have attained a level similar to an adult (Perlmutter & Lange, 1978). Thus, children at third grade level (as in this study) retain more than first graders but less than ten year old children in fourth grade. The age-related developmental improvement in recall may be partially attributed to increased awareness and use of organizational strategies (Orstein & Naus, 1978; Perlmutter & Lange, 1978).

Memory and Reading Ability

As long ago as 1897, researchers were investigating how memory skills and capacities relate to reading (Hawkins, 1897, cited in Farnham-Diggory & Gregg, 1975). The literature indicates that the same processes of encoding, storage, and retrieval are essential to both the memory process and the reading process (Smith, 1975; Torgeson, 1978).

Recall is essential to reading, both in word decoding and in comprehension (Alexander, 1979). The act of decoding words must be accompanied by a retention of retrievable information, otherwise the message is

meaningless. As Robeck and Wilson (1974) explain:

> The process of reading, from the simple recognition of a word to the creative extension of an author's idea, involves the retrieval of meanings stored in the cortex and incorporation of new input with these past experiences. (p. 51)

Hunt (1982) demonstrates that normal reading material is a highly abbreviated form of communication forcing the reader to supply far more information from memory than the words overtly express.

Those who write about modern reading programs stress that heavy demands are placed on all memory skills (Ekwall, 1976; Smith, 1975; Torgeson, 1977). Differences among memory abilities of children affect how well they perform as readers. Research clearly demonstrates that above-average readers have superior short-term memories to below-average readers (Birch & Belmont, 1965; Howe, 1970; Jackson, 1970; McFarland & Rhodes, 1978; Perfetti & Goldman, 1976; Robeck & Wilson, 1974; Torgeson, 1977, 1978).

Evidence linking memory ability with reading ability is conclusive enough that Ekwall (1976) and Kavale (1981) are able to list a number of memory deficits among the list of symptoms for use in identifying disabled readers.

Table 2.1 summarizes four research studies comparing memory and reading in which subjects were lower elementary age children, as are students in this study.

Auditory Memory and Reading Ability

Reading and learning to read involves the integration of all the body senses:

> The visual and auditory systems are of obvious importance in reading and listening. The reticular formation of the

Table 2.1

Summary of Studies

Researcher	Subjects	Memory Tests	Reading Tests	Results
Badian, 1977	60 children Grades 3, 4, 5	- Nine constructed tests - ITPA Auditory Sequential Memory subtest	- Gray Oral Reading Test, Form D - The Stanford Diagnostic Reading Test, Reading Comprehension subtest	Adequate readers were superior on both verbal and non-verbal tasks making demands on short-term auditory sequential memory
Perfetti, Bell & Goldman, 1976	32 children Grades 3, 4	- Constructed tests of 4 stories with 18 probe words each. Subject was to recall the word following the probe.	- Not reported	Skilled readers recalled more targets. Recall was higher with oral reading.
Ritchie & Aten, 1976	40 children mean age 10.8	- Constructed tests, verbal and nonverbal using sounds, dots, words, and pictures	- Comprehensive Tests of Basic Skills (California Test Bureau)	Reading disabled performed significantly poorer than adequate readers.
Rodgers, 1969	100 children Grade 2	- Constructed tests of digits forward, digits backward, letters forward, letters backward, repeating directions and following directions.	- Gates MacGinitie Reading Comprehension Test	Significant differences existed between retarded underachieving readers and competent achievers with or without reinforcement.

> midbrain--where arousal occurs and attention is focused--integrates the messages of different sensory systems. This formation also has many of the sorting and switching functions that relay sensory messages to appropriate areas in the cortex and spinal column. (Robeck & Wilson, 1974, p. 50)

For example, when the eyes see the word "orange," the mind may subvocalize the sound of the word, recall an image of the orange, and/or remember what an orange smells, feels, and tastes like.

Auditory memory appears to be the channel of sensory intake most highly related to reading (Golden & Steiner, 1969), as well as the overall monitor of the reading process (Farnham-Diggory & Gregg, 1975). One study suggests that identical comprehension subskills are involved in reading and listening (Kintsch & Kozminsky, 1977, cited in Downing & Leong, 1982).

In an extensive review of 106 studies which examined the relationship of auditory perceptual skills to reading ability, Kavale (1981) employed meta-analysis techniques to statistically integrate the findings. Kavale's analysis indicates that "auditory perception is an important correlate of reading ability" (p. 539).

Five categories of reading skills are examined: 1) general reading achievement; 2) word recognition; 3) reading comprehension; 4) oral reading; and 5) vocabulary. Auditory perceptual skills are also subdivided into five categories: 1) auditory discrimination; 2) auditory blending; 3) auditory memory; 4) auditory-visual integration; and 5) auditory comprehension.

Results of Kavale's analysis comparing auditory memory with each of the five reading subskills are shown in Table 2.2. Kavale concludes that auditory perceptual skills (auditory memory among them) correlate with reading ability and should be considered as a means to assess and predict

reading achievement.

Table 2.2

Correlation Matrix for Auditory Memory and Reading Skills

Reading Skill	Correlation to Auditory Memory
General Reading	.362
Vocabulary	.415
Oral Reading	.312
Word Recognition	.391
Reading Comprehension	.394

Source: Kavale, 1981, p. 543.

In 1970, McNinch tested 111 children in grade one to examine auditory perception factors and future reading achievement. McNinch shows the preinstruction assessment of auditory memory to be predictive of reading success or failure, when students were reassessed five months later.

Using 11 individualized tests of auditory memory, Owens (1976) conducted a study with 180 children in grades two, four, and six. Gates MacGinitie Reading Tests were used to assess reading ability. Nine of the 11 tests showed a significant correlation of auditory memory to total reading scores, and nine showed a significant correlation to reading comprehension scores.

In addition, other studies show auditory memory is related to reading ability and how it can differentiate above-average and below-average readers (Birch & Belmont, 1965; Cabrini, 1963; Dixon, 1972; Golden & Steiner, 1969; Morency, 1967; Raymond, 1954).

Measurement Instruments

In memory-reading studies, short-term auditory memory has been measured using a variety of stimuli, including: bells, musical tones, nonsense syllables, digits forward, digits backward, and letters backward. The writer agrees with researchers who believe that studies could be strengthened by the development and use of measurement devices and stimulus materials which are more similar to actual reading (Fleming & Ohnmacht, 1977; Kintsch, 1975; Paris, 1978; Torgeson, 1977). Throughout this review of the literature, no studies were found to be the same as the present one. Nor were any studies located in which the stimuli used to measure short-term auditory memory were the same as the reading-task related stimuli in this study.

Sex Differences

Is either sex naturally superior to the other in respect to memory? This study sought to examine sex differences of above-average and below-average readers on four tests of short-term auditory memory. A discussion of sex differences in memory and in reading follows.

Memory

Maccoby and Jacklin (1974) review studies dating from 1931 to 1973, which discuss sex differences in memory. They group and report research in three topic areas: 1) verbal content; 2) those using objects or digits; and 3) those using verbal and non-verbal material. The area of greatest relevance to this study is sex differences in memory measured by means of verbal content.

Nineteen studies were examined, summarized, tabulated, and discussed.

Several of the studies were large scale, equalling a total of 6,691 subjects for the 19 studies. Maccoby and Jacklin (1974) describe their findings:

> Girls show somewhat better memory for verbal content. More than half the studies have found no sex differences, but when differences are found, girls have higher scores in every case. The superiority of girls in verbal memory is especially clear after about the age of 7. (p. 59)

They further summarize regarding total memory:

> . . . verbal content in a memory task may give some advantage to girls, but it clearly cannot be said that either sex has a superior memory capacity, or a superior set of skills in the storage or retrieval of information, when a variety of content is considered. Nor does existing evidence point to a difference in choice of mnemonic strategies. (Maccoby & Jacklin, 1974, p. 59)

Thus, if sex differences are found in this study one might expect girls to have the edge but not by a significant amount.

Reading

Generally, researchers have found that North American girls are better readers than boys (Downing & Leong, 1982). They caution, however, that sex differences in reading ability and in attitudes toward reading are not universal across all cultures. For example, in Nigeria, India, Germany, Finland, England, and Denmark, boys show superior trends. Klein (1979) argues that in order to prove a biological superiority of either sex in reading, results would have to be consistent across cultures.

Statistics indicate that North American boys have more difficulty learning to read than girls, and that 70 to 80% of all reading disability students in the United States are boys (Stanchfield, 1973). Downing and Leong (1982) also indicate that North American girls have

more positive attitudes toward reading than boys. One could enter a lengthy discussion of reasons for this difference in attitude and performance but that is not within the scope of this study.

There is some evidence to dispute the superiority of North American girls in reading. Crowell (1978) reported that boys and girls differed little. McNinch (1970) found no statistically significant difference, only a "positive trend of superiority by girls was noted on all measures" (p. 489).

Sex differences in reading disappear when adulthood is reached (Klein, 1977). This adds weight to the argument that sexual superiority in reading at a given age, in a given nation, can be attributed more to culturally induced attitudes, interests, and sex-biased content of tests rather than to any natural biological superiority (Klein, 1977).

Cloze Procedure as a Measure of Reading Ability

Taylor (1953) described cloze procedures as a technique to measure effective communication. Subsequent investigations have demonstrated that cloze procedures measure reading comprehension (Bormuth, 1962; Gallant, 1965; Kirby, 1968; Rankin, 1957). Furthermore, investigators have shown that cloze can be used to assess differences in children's reading ability by comparing cloze with other reading tests:

> In assessing the accuracy of cloze tests for determining children's reading levels, researchers have compared cloze tests results with multiple-choice comprehension tests, with oral reading tests, and with informal reading inventories. In all cases the results have been similar. (Mork, 1971, p. 763)

Cloze procedure has been further validated by comparing cloze tests constructed from the same passages used in the other reading tests thereby controlling for differences in interest and difficulty (Klein, 1981).

A cloze test can be constructed from any passage by deleting every n^{th} word and replacing it with an underscored blank of uniform length. The most frequently used deletion pattern is every fifth word. "However, it is customary to preserve one or more complete sentences to provide an unmutilated introduction to a cloze test" (Klein, 1972, p. 13). A total of 30 deleted words would constitute a reliable test (Klare, 1966). Examinees are asked to fill in each space with one word that best fits the context of the passage.

Two scoring methods may be used for cloze: the exact cloze score or the substitute cloze score. The exact cloze score is the number of responses made by the reader in which the word supplied is the deleted word, ignoring minor misspellings. The substitute cloze score is the combined score of exact responses and accepted synonyms which are semantically and syntactically correct (Gallant, 1965).

Results of studies of comparisons of exact cloze scores and substitute cloze scores show non-significant differences in correlations (Gallant, 1965). Klein (1972) points out the complications of weighting and scoring synonym responses. The exact cloze score is preferable (Gallant, 1965; Mork, 1971) and is the scoring method which was used in this study.

Chapter III

METHODOLOGY

Chapter III describes the sample, the materials and the procedures used to examine the short-term auditory memory of above-average and below-average third grade readers. The chapter is divided into three sections: 1) the sample, 2) the experimental procedures for screening, grouping, and individual testing; and 3) the treatment of data.

The Sample

Five grade three classes from four Saskatoon Catholic schools participated in this study. The Coordinator of Research selected schools to represent the socio-economic distribution of children in the system. A total of 120 children were screened to identify above-average and below-average readers. A total of 62 children, 32 boys and 30 girls, were administered four individual tests of short-term auditory memory.

Experimental Procedures

The data collection for this investigation involved three main steps.

1. Screening - 120 grade three children were screened to identify above-average and below-average readers.

2. Grouping - Children were identified to participate in step

three on the basis of:

a) reading scores obtained by screening

b) a teacher elimination checklist (see Appendix C)

c) sex.

Four groups were identified--above-average boys, above-average girls, below-average boys, and below-average girls.

3. Testing - 62 children in the four groups were each administered four individual tests of short-term auditory memory.

Screening

The purpose of screening was to identify two groups--above-average and below-average readers. The children were assessed with a cloze test to measure reading ability. Finally, the teacher checklist confirmed that cloze screening identified the above-average and below-average readers in their classes.

Cloze test. The cloze test, completed by all children in the sample, consisted of three graded passages from the McCracken Standard Reading Inventory, Form A (McCracken, 1963). Cloze tests were constructed from the passages as per definition with every fifth word deleted. The first passage, used for practice, was at a grade one level to ensure that the procedure would be fully understood by even the lowest readers. The remaining two passages, used for screening, were at a grade three level as indicated in Table 3.1.

Individual booklets were prepared for each child. Booklets contained the three passages on separate pages typed with triple spacing (see Appendix A).

Table 3.1

Cloze Passages for Screening

Passage	Level	Total Words	Total Deleted Words	Purpose
Bill	1-2	69	12	Practice
Night	3-1	79	14	Test
A Gift	3-2	90	16	Test
TOTAL	(Tests)	169	30	

Administering cloze. The researcher administered the cloze test to each class in a morning session lasting approximately 45 minutes. Administration consisted of three steps repeated with each class.

1. Introduction. The following introduction was given to each class:

> Good morning boys and girls. My name is Mrs. Caruk. I am from the University of Saskatchewan. I am here to learn about the way children read and I would like your help. You will be reading three short stories and filling in some blank spaces. I hope you will try your very best. You will need a pencil and an eraser.

Student booklets were distributed and children were instructed to print their full names at the top of the first page.

2. Practice Session. To ensure that all children understood how to take a cloze test, practice was given with the grade one passage. The passage "Bill" was projected on a screen at the front using an overhead projector. The researcher said the following:

> This is the first story and it is for practice. There are some words missing but if you read quickly you can still get the idea of the story. Now read it to yourself.

Sufficient time was allowed for all children to read the passage silently. The story was discussed together and an appropriate word was printed in each deleted space of the transparency with a grease pencil. It was demonstrated that:

a) only one word be used in each deleted space

b) that reading ahead or back was helpful

c) that misspelled words were not errors

d) that each word should agree with the rest of the sentence in tense, gendre, and/or number.

After the practice passage had been completed, and it appeared that all children understood the procedure, instructions were given to complete the second and third passages independently. Children were to:

a) reread both passages when finished

b) raise their hands to have the booklet collected

c) read a book quietly until all children finished.

Sufficient time was allowed for all children to complete both test passages.

Scoring cloze. The exact score method, as described in Chapter II, was used. The two test passages were combined to obtain a total of 30 deletions. One point was awarded for each correct response matching those in Appendix B. Misspelled words were not counted as errors, e.g., 'thay' for 'they'. Errors in gendre, tense and/or number were counted as errors, e.g., 'she' for 'he'; 'was' for 'were'; or 'he' for 'they'. To facilitate scoring, a clear plastic overlay of the correct responses for each passage was used. All scoring was done by the researcher.

Grouping

The purpose of grouping was to identify four distinct groups for the individual testing of short-term auditory memory in this study: above-average boys, above-average girls, below-average boys, and below-average girls. Grouping procedures involved three phases:

1. Preparing two student lists ordering highest to lowest cloze scores--one for boys and one for girls.

2. On the basis of a teacher checklist (see Appendix C), eliminating children who would not participate in the individual testing in this study because he/she

   a) had accelerated, or

   b) had repeated a grade, or

   c) had a hearing impairment, or

   d) was outside of 85 to 115 IQ range, or

   e) did not speak English as the first language.

3. Listing the names of children in the four final groups to be administered the individual tests of short-term auditory memory.

Eliminated were those identified above (a-e), and those who fell in the average group of readers. Thus, the experimenter retained four groups of girls and boys who were tested individually. Means, standard deviations and ranges of the groups are shown in Figure 3.1. There were fewer girls than boys thus resulting in unequal groups.

Testing

The purpose of individual testing of short-term auditory memory tests was two-fold: 1) to examine and compare the performance of above-average readers and below-average readers; 2) to examine and compare the

		BOYS	GIRLS
Above-Average Readers	N	16	16
	M	16.38	16.19
	Σ	(0.81)	(1.17)
	R	15-18	14-18
Below-Average Readers	N	16	14
	M	9.25	10.14
	Σ	(1.06)	(3.08)
	R	8-11	4-13

N = Number
M = Mean Score
Σ = Standard Deviation
R = Range

Figure 3.1 Groups for final testing

performance of boys and girls. Each of the 62 children in the four groups was administered four tests of short-term auditory memory by the researcher.

Memory tests. The four tests of short-term auditory memory in this study used stimuli similar to the stimuli encountered in the reading process--letters, words, sentences, and a paragraph. The names of the four tests used were: 1) Memory for Consonant Names (MTI); 2) Memory for Words (MT2); 3) Memory for Sentences (MT3); and 4) Memory for a Story (MT4). Table 3.2 identifies the source of each test and its original name. The content of each test remained exactly as in the original.

Table 3.2

Short-Term Auditory Memory Tests

Test Name	Original Name and Source
Memory for Consonant Names	Detroit Tests of Learning Aptitude Subtest 16 Visual Attention Span for Letters (Baker & Leland, 1959a)
Memory for Words	Detroit Tests of Learning Aptitude Subtest 6 Auditory Attention Span for Unrelated Words (Baker & Leland, 1959a)
Memory for Sentences	Woodcock-Johnson Psycho-Educational Battery Subtest 3 Memory for Sentences (Woodcock & Johnson, 1977b)
Memory for a Story	Durrell Analysis of Reading Difficulty, Third Edition Silent Reading Subtest 2A "The House" (Durrell & Catterson, 1980)

Student booklets and test tapes were prepared before individual testing sessions began. Each child's booklet (as shown in Appendix D) provided spaces to record responses, scores, and comments. Booklets were labelled beforehand with the name and the random order in which the four tests were to be administered. Test orders were assigned to booklets in each group using the chart in Appendix E. Booklets were not identified by reading level until after testing was completed.

Memory tests were recorded on four separate cassette tapes and the same four tapes were used with all students. Each tape began with directions for the stimuli contained on that tape (see Appendix F). All directions and test stimuli were recordings of the researcher's voice. All tests, except Memory for a Story, began with one practice example.

In Memory for Consonant Names and Memory for Words, tapes were prepared with one second intervals between stimuli. Each set of stimuli was followed by an appropriate length pause to allow the child to respond orally to the stimuli without the distraction of stopping the test tape.

In Memory for Sentences and Memory for a Story, tapes were recorded at the rate of approximately 70 words per minute, the average grade three oral reading rate (McCracken, 1963). Each sentence in Memory for Sentences was followed by an appropriate length pause to allow the child to respond orally to the test stimuli while allowing the test tape to continue running. Memory for a Paragraph was presented in its entirety and the child responded immediately after.

Administering memory tests. The individual testing of short-term memory of the 62 children in the four groups was done by the researcher.

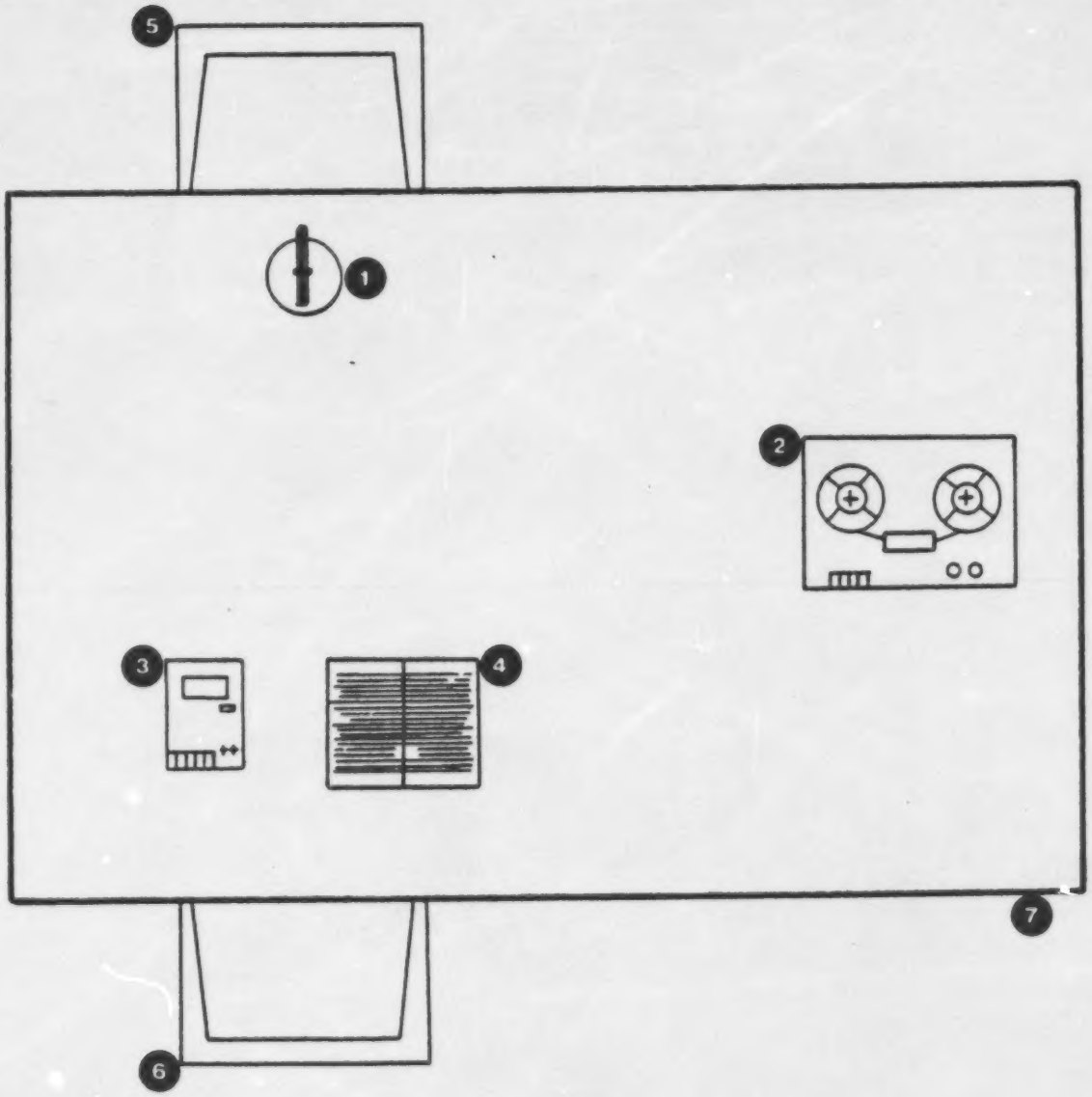
Each child was tested in a single session lasting approximately 20 minutes. Testing was carried out in a quiet room in each school with materials and furniture prearranged as shown in Figure 3.2.

The examiner accompanied each child from the classroom to the testing room. An effort was made to establish rapport and eliminate apprehension before actual testing began. The student information section of the booklet was completed while chatting informally. The examiner read the following introduction:

> My name is Joan. I am a university student learning how to help children to read better. We will be listening to four cassette tapes and I will ask you to do some things. These are not tests. They will tell us how well you can remember. My voice on the tape will tell you what to do. I will be marking some things down while you answer. I will stop the tape whenever you need more time. Each tape gets harder toward the end but please try all of them. Do you have any questions?

The child and the researcher then put on headphones connected to the tape player. Each session was recorded on a reel recorder for use in checking and scoring after the test session. The prerecorded test tapes were presented in the random order indicated on the test booklet. The researcher recorded the child's responses to each set of stimuli in his/her booklet exactly as spoken. When extra time was required for the child to respond, the 'pause' button of the tape player was used. All children completed all tasks of the four tests of short-term auditory memory. No stimuli were repeated.

Scoring memory tests. Free recall was measured by means of the simple score method employed by Baker and Leland (1959b). This method allots a credit of one point for every letter or word recalled regardless of order. Tests were scored using the following criteria:



1. Microphone (Reel to Reel Recorder)
2. Reel to Reel Recorder
3. Cassette Player
4. Student Booklet
5. Student's Chair
6. Examiner's Chair
7. Table

Figure 3.2 Arrangement of testing rooms

1. Memory for Consonant Names - One point was credited for each correct consonant name the child spoke after hearing each set of stimuli. For example, if a child said "q, l, r, n" following presentation of the stimuli "q, l, d, n, r" 4 points were allotted. Points for the 24 sets of consonant names were totalled for the Memory for Consonant Names test score.

2. Memory for Words - One point was credited for each correct word the child spoke after hearing each set of stimuli. For example, if a child said "west, pipe, coke, mule" following presentation of the stimuli "pipe, west, fence, coat, mule," three points were allotted. Points for the 14 sets of words were totalled for the Memory for Words test score.

3. Memory for Sentences - One point was credited for each correct word the child spoke after hearing each sentence stimulus. For example, when a child said "Rocks may be used to make interesting gardens" following presentation of the sentence "Rocks may be used to make an interesting garden," seven points were allotted. Points for the 22 sentences were totalled for the Memory for Sentences test score.

4. Memory for a Story - One point was credited for each word from the story that the child spoke after hearing the story once. Following is an example of a child's response with credited words underlined.

The House

They built a house. They had a table, some old chairs, and a basket of apples. One day they left the door open. They came back and saw some pigs eating.

Twenty-six points were allotted this response.

The range of scores for each test of short-term auditory memory is presented in Table 3.3.

Table 3.3

Range of Possible Scores on Short-Term Auditory Memory Tests

Test Name	Score Range
Memory for Consonant Names	0-108
Memory for Words	0-70
Memory for Sentences	0-215
Memory for a Story	0-52

The accuracy of previously transcribed responses was checked using the tape recordings of the test sessions. Booklets were scored and totalled by the researcher.

Pilot Study

Prior to the present study, a pilot study was conducted involving 27 grade three children. It sought to determine 1) the efficacy of using cloze procedures, 2) preferred scoring procedures, and 3) the adequacy of the researcher's oral instructions.

Treatment of Data

This study sought to answer two main questions:

1. Are there any differences in performance of above-average and below-average grade three readers on short-term auditory memory tasks?

2. Are there any differences in performance of grade three girls and grade three boys on short-term auditory memory tasks?

The experimental design involved two factors: reading ability and sex as shown in Figure 3.3. Differences between group scores for four

short-term auditory memory tests were assessed by analysis of variance (ANOVA) procedures. Four hypotheses were tested comparing above-average readers with below-average readers and four hypotheses were tested comparing boys and girls. Interaction of reading ability and sex was examined. The .05 level of significance was used for all eight hypotheses.

READING ABILITY \ SEX		
	ABOVE-AVERAGE BOYS	ABOVE-AVERAGE GIRLS
	BELOW-AVERAGE BOYS	BELOW-AVERAGE GIRLS

Figure 3.3 Experimental design used with each of four short-term auditory memory tests

Chapter IV

RESULTS

The purpose of this study was to examine the performance of above-average and below-average grade three readers on four tests of short-term auditory memory and to compare the performance of boys and girls. One hundred and twenty children were screened for reading ability using a cloze version of the McCracken Standard Reading Inventory grade three passages (McCracken, 1963). Four experimental groups were identified: above-average boys, above-average girls, below-average boys, and below-average girls. Table 4.1 shows the mean score and standard deviation results of the cloze test.

Table 4.1

Means Raw Scores and Standard Deviations on Cloze Reading Test Used for Screening

Group	Number	Mean Score	Standard Deviation
Above-Average Boys	16	16.38	0.81
Above-Average Girls	16	16.19	1.17
Below-Average Boys	16	9.25	1.06
Below-Average Girls	14	10.14	3.08
Total Group	62	13.08	3.75

Following identification of the four experimental groups, four tests of short-term auditory memory were individually administered to 62

children: Memory for Consonant Names, Memory for Words, Memory for Sentences, and Memory for a Story. Complete data were obtained for all 62 children on all four tests.

Table 4.2

Mean Raw Scores and Standard Deviations on Four Short-Term Auditory Memory Tests for Four Experimental Groups

Group	Memory for Consonant Names M (SD)	Memory for Words M (SD)	Memory for Sentences M (SD)	Memory for a Story M (SD)
Above-Average Boys	73.94 (9.38)	42.25 (5.45)	169.06 (15.98)	33.76 (7.11)
Above-Average Girls	76.63 (9.37)	41.44 (5.56)	169.75 (14.33)	35.19 (8.19)
Below-Average Boys	68.50 (8.03)	33.38 (5.45)	143.75 (18.03)	27.38 (9.65)
Below-Average Girls	66.43 (11.66)	33.71 (7.56)	155.64 (17.76)	24.36 (I2.72)
Total Group	71.53 (10.24)	37.82 (7.21)	159.68 (19.50)	30.31 (10.28)

Results were analyzed by means of the analysis of variance (ANOVA) procedure subprogram from the Statistical Package for the Social Sciences (Nie et al., 1975). Reading ability, sex, and interaction of reading ability and sex were examined and analyzed separately for each of the four short-term auditory memory tests using two-way analysis of variance. In addition, multiple classification analysis was carried out in order to examine the pattern of the relationship of reading ability and sex to short-term auditory memory for each of the four tests.

This chapter discusses each test separately in the following order:

Memory for Consonant Names, Memory for Words, Memory for Sentences, and Memory for a Story. Table 4.2 gives the means and standard deviations of the four experimental groups, as well as the total group on the four tests of short-term auditory memory.

Memory for Consonant Names

Results of the two-way analysis of variance on Memory for Consonant Names are indicated in Table 4.3.

Table 4.3

Two-Way Analysis of Variance for Memory for Consonant Names

Source	Degrees of Freedom	MS	F	P
Reading Group	1	935.354	9.987	0.003*
Sex	1	2.354	0.025	0.874
Reading Group X Sex	1	87.466	0.944	0.335
Error	58	92.657		

* $p < .05$

Reading Group Factor

Table 4.2 shows that mean differences between the above-average reading group and the below-average reading group were significant for Memory for Consonant Names. Null hypothesis one (There will no be difference in performance between above-average and below-average readers on Memory for Consonant Names) is therefore rejected.

Sex Factor

Differences between girls and boys on Memory for Consonant Names were not significant. Null hypothesis five (There will be no difference in performance between girls and boys on Memory for Consonant Names) is accepted at the .05 level of significance.

Interaction

Results of the two-way analysis of variance indicated no interaction between the variables of reading group and sex.

Multiple Classification Analysis

The reading group factor (above-average and below-average readers) explained 14.44% of the total variation while the sex factor explained less than 1%. Jointly, sex and reading group explained 14.6% of the total variation on Memory for Consonant Names. The overall relationship between the criterion variable (Memory for Consonant Names) and the independent variables of sex and reading group was .382.

Memory for Words

Results of the two-way analysis of variance for Memory for Words are found in Table 4.4.

Reading Group Factor

Results indicated a significant mean difference between reading groups. Null hypothesis two (There will be no difference in performance between above-average and below-average readers on Memory for Words) therefore is rejected.

Table 4.4

Two-Way Analysis of Variance for
Memory for Words

Source	Degrees of Freedom	MS	F	P
Reading Group	1	1070.374	29.597	0.000*
Sex	1	1.017	0.028	0.867
Reading Group X Sex	1	5.123	0.142	0.708
Error	58	36.165		

* $p < .05$

Sex Factor

Girls' and boys' performances showed no significant mean differences, thus null hypothesis six (There will be no difference in performance between girls and boys on Memory for Words) is accepted at the .05 level of significance.

Interaction

Two-way analysis of variance results showed no significant interaction between reading groups and sex.

Multiple Classification Analysis

In Memory for Words, the reading group factor (above-average and below-average readers) explained 33.64% of the total variation and the sex factor explained less than 1%. Jointly, reading group and sex explained 33.7% of the variation. The overall relationship between the criterion variable (Memory for Words) and the independent variables of sex and reading group was .581.

Memory for Sentences

Table 4.5 indicates results of the two-way analysis of variance for Memory for Sentences.

Table 4.5

Two-Way Analysis of Variance for Memory for Sentences

Source	Degrees of Freedom	MS	F	P
Reading Group	1	6126.812	22.369	0.000*
Sex	1	574.945	2.099	0.153
Reading Group X Sex	1	484.921	1.770	0.189
Error	58	273.899		

* $p < .05$

Reading Group Factor

Significant mean differences were found between above-average and below-average reading groups for Memory for Sentences. Hence, null hypothesis three (There will be no difference in performance between above-average and below-average readers on Memory for Sentences) is rejected.

Sex Factor

Mean differences between sexes for Memory for Sentences were not significant, therefore null hypothesis seven (There will be no difference in performance between girls and boys on Memory for Sentences) is accepted at the .05 level of confidence.

Interaction

No interaction of reading groups and sex was evident in Memory for Sentences.

Multiple Classification Analysis

The reading group factor explained 26.01% of the total variation in Memory for Sentences. Sex explained 2.56% of the total variation. Reading group and sex jointly explained 29.5% of the total variation in Memory for Sentences. The overall relationship between the criterion variable (Memory for Sentences) and the independent variables of sex and reading group was .543.

Memory for a Story

Two-way analysis of variance results for Memory for a Story are shown in Table 4.6.

Table 4.6

Two-Way Analysis of Variance for Memory for a Story

Source	Degrees of Freedom	MS	F	P
Reading Group	1	1098.845	12.104	0.001*
Sex	1	5.867	0.065	0.800
Reading Group X Sex	1	83.251	0.917	0.342
Error	58	90.782		

* $p < .05$

Reading Group Factor

Results of the fourth test of short-term auditory memory indicated a significant mean difference between reading groups. Null hypothesis four (There will be no difference in performance between above-average and below-average readers on Memory for a Story) is rejected.

Sex Factor

Mean differences between girls and boys were not significant at the .05 level of confidence. Null hypothesis eight (There will be no difference in performance between girls and boys on Memory for a Story) is accepted.

Interaction

Interaction of sex and reading groups was not significant for Memory for a Story.

Multiple Classification Analysis

Less than 1% of the variation in Memory for a Story is explained by the sex factor. The reading group factor explained 16.81%, while sex and reading group jointly explained 17.1% of the total variation. The overall relationship between the criterion variable (Memory for a Story) and the independent variables of sex and reading group was .413.

Summary

Two-way analysis of variance procedures were used to compare the ability of grade three boys and girls of above-average and below-average reading groups to perform four tests of short-term auditory memory: Memory for Consonant Names, Memory for Words, Memory for Sentences, and

Memory for a Story.

Significant mean differences were found for reading groups (above-average and below-average) on all four tests ($p < .05$). No significant mean differences occurred for sex on any of the four short-term auditory memory tests at the .05 level of significance.

Interaction of reading group and sex was not significant for any of the four tests at the .05 level of significance.

Chapter V

FINDINGS AND CONCLUSIONS

The Study

This study examined the performance of above-average and below-average grade three girls and boys on four tests of short-term auditory memory. The individually administered tests were: Memory for Consonant Names, Memory for Words, Memory for Sentences, and Memory for a Story. The auditory stimuli used in the respective tests were: letters, words, sentences, and a paragraph. Children listened to stimuli from cassette tapes and responded orally. The short-term auditory memory tests measured free recall of stimuli.

Subjects were 62 grade three children attending urban Catholic schools who:

1. had not repeated a grade;
2. had not accelerated;
3. were within 85 to 115 IQ range;
4. had no known hearing impairment; and
5. spoke English as the first language.

Findings

The following eight null hypotheses were tested at the .05 level of significance using analysis of variance procedures:

1. There will be no difference in performance between above-average and below-average readers on Memory for Consonant Names.

2. There will be no difference in performance between above-average and below-average readers on Memory for Words.

3. There will be no difference in performance between above-average and below-average readers on Memory for Sentences.

4. There will be no difference in performance between above-average and below-average readers on Memory for a Story.

5. There will be no difference in performance between girls and boys on Memory for Consonant Names.

6. There will be no difference in performance between girls and boys on Memory for Words.

7. There will be no difference in performance between girls and boys on Memory for Sentences.

8. There will be no difference in performance between girls and boys on Memory for a Story.

Null hypotheses one through four were rejected while null hypotheses five through eight were retained. Results of two-way analysis of variance and multiple classification analysis indicated that above-average readers scored significantly higher than below-average readers on each of four tests of short-term auditory memory: Memory for Consonant Names, Memory for Words, Memory for Sentences, and Memory for a Story. Differences between sexes were minimal for all four tests. There was no interaction between sex and reading group for any of the four tests.

Conclusions

Within the limitations of this study, the following two conclusions seem appropriate:

1. Above-average readers in grade three have better short-term auditory memories than below-average readers in grade three.

2. The short-term auditory memory ability of girls and boys in grade three appears to be equal.

Implications

This study resulted in two conclusions which have implications for education:

1. No significant difference in short-term auditory memory ability of girls and boys in grade three was evident.

2. Above-average readers have superior short-term auditory memory abilities to below-average readers in grade three.

The first conclusion demonstrated that it is not necessary to compensate for a biological short-term auditory memory inferiority for either of the sexes. Girls and boys have equal advantages to learn via the short-term auditory memory channel without adjustment of teaching style or materials.

The second conclusion, however, that above-average readers have superior short-term auditory ability to below-average readers, has implications for: 1) diagnosis; 2) remediation; and 3) compensation.

Diagnosis

This study demonstrated the variation in short-term auditory memory ability that could exist in a class of children. As Smith (1975)

indicates:

> Teachers are not always aware of the quite natural limitations that the minds of all children (and all adults) are heir to, and acquaintance with these limitations can help them to understand better some of the difficulties that confront children. (p. 5)

Some children require more attempts at remembering (Howe, 1970). Golden and Steiner (1969) believe that early diagnosis of children with weak short-term memory can prevent failure experiences.

Ongoing observations can provide clues that children have a short-term auditory memory problem. Symptoms include inability to remember directions, difficulty in concentration, short or erratic memory for words, and/or difficulty in sequencing (Ekwall, 1976). A formal test can be administered to confirm observations.

A diagnosed deficit in short-term auditory memory is predictive of future reading failure (Kavale, 1981; McNinch, 1970), thus making early diagnosis essential (Kavale, 1981). Following identification of children with a short-term auditory memory problem, attention can be focused on remediation of the deficit, and/or compensating for the deficit.

Remediation

Remediation of short-term auditory memory deficits could take one of the following approaches or a combination of the two:

1. Direct teaching of organizational skills and strategies to improve memory; and/or

2. Expanding the permanent memory base.

While some researchers propose that disabled readers have a specific disability in short-term memory which limits or restricts their

attainment of reading skills (Guthrie & Goldberg, 1972; Koppitz, 1976), others believe memory deficits reflect a lack of ability to employ efficient strategies (Golden & Steiner, 1969; Rodgers, 1969; Torgeson, 1977). Children can be taught to engage in deliberate organization and rehearsal strategies (Orstein & Naus, 1978; Perlmutter & Lange, 1978). Some of the methods discussed are chunking, clustering, organizing according to semantics, using visual imagery, and mnemonic strategies such as peg word lists. With the preceding approach, efforts are concentrated on how to remember rather than what to remember.

The second approach to remediation, expanding the permanent memory base, implies increased exposure to the environment. The importance of the memory base to the overall process of memory was discussed in Chapter II. Hunt (1982) summarizes:

> . . . the extent to which we remember a new experience has more to do with how it relates to existing memories than with how many times or how recently we have experienced it, or how much interfering scribble there is. (p. 96)

Thus, children should have opportunities to express and share experiences, and to be active participants in the learning process. A multitude of stimuli could be utilized in a variety of ways to enhance the short-term auditory memory skills, such as: songs, nursery rhymes, stories, poems, records, tape recordings, and games.

Compensation

Research points out the wide variation of ability with which children are able to store and retrieve information. Ekwall (1976), in a discussion of "rate of learning" (p. 257), demonstrates the range in the amount of time and number of repetitions required for children to learn a sight word. This suggests adjusting the rate and decreasing the amount

of incoming information for children who are at a disadvantage.

In addition there are varying degrees of ease and efficiency with which children perceive either auditory or visual stimuli (Morency, 1967; Smith, 1975). Telford and Sawry (1981) suggest that teachers focus and capitalize on the individual's area of strength in order to circumvent the weakness. A multisensory approach is best--hear, see, touch, taste, and smell (Ekwall, 1976; Sattler, 1982). One which employs all the senses and capitalizes on the child's interests is ideal. Buzan and Dixon (1978) emphasize:

> . . . the clearer the images entering the brain, the 'clearer' the memory of those images will be, and the more proficient the general functioning of the mind will be. It can be seen then that perception aids memory, that memory aids learning, that learning aids perception. We therefore have a cycle in which, if each element is improved, the others automatically improve. (p. 55)

Recommendations for Further Research

1. Perlmutter and Lange (1978) report that ten year old children have attained the same level as adults in short-term recall. A study similar to this investigation, involving children who are eight, ten, and 12 years old is recommended.

2. The same four tests of auditory memory used in this study could be used with kindergarten children to examine the tests' ability to predict future reading success or failure.

3. Kavale (1981) reports IQ as a factor related to both auditory perceptual ability and reading ability. A study in which above-average readers and below-average readers are matched for IQ could provide insight into the organizational processes and strategies employed by children with above-average short-term auditory memory ability.

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APPENDIX A

Cloze Booklet

Name _____

BILL

Bill had a toy cat. He took it outside _____ play. Night came. Bill _____ not bring in his _____ cat. It rained that _____. The next day Bill _____ for his cat. "Mother," _____ called. "I lost my _____. Will you help me?" _____ do you think it _____?" said mother. Bill did _____ know. "Let's look outside," _____ Mother. Bill found his _____ cat in the street.

A GIFT

Henry was delighted when his parents gave him a camera. He darted out of _____ house immediately and looked _____ something to take a _____. He saw a soldier _____ horseback and took his _____. He took another of _____ policeman near the traffic _____. He was so excited _____ so interested that he _____ it was lunch time. _____ was hungry so he _____ home. When he got _____ his father and mother _____ with laughter. They told _____ there was no film _____ the camera. Henry felt _____.

NIGHT

Bob climbed into his bed. He put his head _____ his pillow.

Slowly he _____ falling asleep. Bob looked _____ the

window and saw _____ moon shining through the _____.

Suddenly he heard something _____ around under his window.

_____ sat up on the _____ of his bed. First _____

was a loud pounding. _____ somebody whistled and something

_____ to the ground. Bob _____ frightened. He pulled

his _____ up over his head _____ pretended to be asleep.

APPENDIX B

Cloze Test Answers

Name _____

BILL

Bill had a toy cat. He took it outside ___to___ play. Night came. Bill ___did___ not bring in his ___toy___ cat. It rained that ___night___. The next day Bill ___looked___ for his cat. "Mother," ___he___ called. "I lost my ___cat___. Will you help me?" ___Where___ do you think it ___is___?" said mother. Bill did ___not___ know. "Let's look outside," ___said___ Mother. Bill found his ___toy___ cat in the street.

A GIFT

Henry was delighted when his parents gave him a camera. He darted out of ___the___ house immediately and looked ___for___ something to take a ___picture___. He saw a soldier ___on___ horseback and took his ___picture___. He took another of ___a___ policeman near the traffic ___light___. He was so excited ___and___ so interested that he ___forgot___ it was lunch time. ___Henry___ was hungry so he ___hurried___ home. When he got ___there___ his father and mother ___howled___ with laughter. They told ___him___ there was no film ___in___ the camera. Henry felt ___foolish___.

NIGHT

Bob climbed into his bed. He put his head ___on___ his pillow. Slowly he ___was___ falling asleep. Bob looked ___out___ the window and saw ___the___ moon shining through the ___trees___. Suddenly he heard something ___moving___ around under his window. ___Bob___ sat up on the ___edge___ of his bed. First ___there___ was a loud pounding. ___Then___ somebody whistled and something ___crashed___ to the ground. Bob ___felt___ frightened. He pulled his ___blanket___ up over his head ___and___ pretended to be asleep.

APPENDIX C

Teacher Checklist

Teacher _____ School _____

Name of Student	Has repeated	Has accelerated	Has a hearing impairment	English not spoken as first language at home	IQ above 115	IQ below 85

APPENDIX D

Student Booklet

STUDENT BOOKLET

Name _____ School _____

Birthdate _____ Age _____ Sex _____

Date Tested _____ Order Tested _____

Scores: MT1 ____ MT2 ____ MT3 ____ MT4 ____

MEMORY FOR CONSONANT NAMES

1.	c q _ _		
2.	x p _ _		
3.	f v _ _		
4.	k x _ _		
5.	b m r _ _ _		
6.	d n v _ _ _		
7.	h b d _ _ _		
8.	m c w _ _ _		
9.	g z f s _ _ _ _		
10.	j p y c _ _ _ _		
11.	q v l t _ _ _ _		
12.	p m k t _ _ _ _		
TOTAL OF COLUMN 1			
13.	z t b r c _ _ _ _ _		
14.	q l d n r _ _ _ _ _		
15.	y f p q g _ _ _ _ _		
16.	s q g f j _ _ _ _ _		
17.	b v n y g b _ _ _ _ _ _		
18.	h x m j w d _ _ _ _ _ _		
19.	w z s b x v _ _ _ _ _ _		
20.	f p c l s n _ _ _ _ _ _		
21.	m z r f b s k _ _ _ _ _ _ _		
22.	v q s j d c h _ _ _ _ _ _ _		
23.	d b x c h q n _ _ _ _ _ _ _		
24.	b d s v k p h _ _ _ _ _ _ _		
TOTAL OF COLUMN 2			
PLUS COLUMN 1			
TOTAL			

COMMENTS: _____

MEMORY FOR WORDS

1. cat ice

2. dog ship

3. man horse song

4. pen girl cow

5. cart bird desk road

6. chair hen book vest

7. head milk dress oats night

TOTAL OF COLUMN 1 ____

8. pipe west fence coat mule

9. fish clock heart sun box frog

10. stone blot freeze door cut white

11. skirt plant friends east tub barn hair

12. mud vase north ten rain cross shoe

13. ear boat key pig south knob ink rope

14. flour skate fan spend lamp wool axe toad

TOTAL OF COLUMN 2 ____

PLUS COLUMN 1 _____

TOTAL ____

COMMENTS:

MEMORY FOR SENTENCES

			*	**	
1.	Big house.		2	-	
2.	Down the hill.		3	5	
3.	Come with me.		3	8	
4.	The car is blue.		4	12	

* Number of words per sentence
** Running total

5.	Trees grow very tall.		4	16	
6.	Some TV sets are big.		5	21	
7.	A bus can hold many people.		6	27	
8.	Use a towel to wipe glasses.		6	33	
9.	Grocery stores sell many kinds of food.		7	40	
10.	A school is a large building with many rooms.		9	49	
11.	Some dogs have learned how to do tricks.		8	57	
12.	The shape of a leaf tells what kind of tree it is.		12	69	
13.	Rocks may be used to make an interesting garden.		9	78	
14.	The church bells rang and rang all day last Sunday.		10	88	
15.	Trains are taking more people than ever to different parts of the country.		13	101	
16.	It is possible to put so much color in a picture that some people will not like it.		18	119	
17.	There are some people who like to do things that other people don't like to do at all.		18	137	
18.	Many trucks carry loads from one place in the country to another.		12	149	
19.	All kinds of life live in the sea and along its rocky and sandy shores.		15	164	
20.	Bright colors such as yellow, red, and orange are used to paint signs that can be seen from far away.		20	184	

MEMORY FOR SENTENCES (CONT.)

71

21. While looking through a camera, assume the camera has a good viewing system if the image is big, bright, and clear.

21 19$

22. Emergency employees may be called any time throughout the day to provide extra manpower or whenever the city needs it.

20 21$

TOTAL ___

COMMENTS:

MEMORY FOR A STORY

The House

Three children		under the table.	
built a house		One afternoon	
in the woods.		they went out	
They put a table		and left the door open.	
and two old chairs in it.		When they came back	
There was a basket		they saw two little pigs	
full of apples		eating the apples.	

TOTAL ___

COMMENTS:

___ Used synonyms not affecting meaning.
___ All in sequence.
___ Needed no prompting.
___ Added ideas changing meaning.
___ Confused the order.
___ Said "I forgot".

APPENDIX E

Random Order for Tests for
Each Experimental Group

1 2 3 4

1 2 4 3

1 3 4 2

1 4 3 2

2 3 4 1

2 3 1 4

2 4 1 3

2 1 3 4

3 4 1 2

3 2 1 4

3 2 4 1

3 1 2 4

4 1 2 3

4 2 1 3

4 3 2 1

4 2 3 1

APPENDIX F

Directions Preceding Short-Term
Auditory Memory Tests

Memory for Consonant Names

I am going to say some letters to you. Listen carefully and when I get all through I want you to say just what I said. Tell the letters in the same order if you can. Do you understand? (Pause until student responds.) Now listen.

Memory for Words

I am going to say some words to you. Listen carefully and when I get all through I want you to say just what I said. Tell the words in the same order if you can. Do you understand? (Pause until student responds.) Now listen.

Memory for Sentences

I am going to say some sentences to you. Listen carefully and when I get all through I want you to say just what I said. Tell the sentences in the same order if you can. Do you understand? (Pause until student responds.) Now listen.

Memory for a Story

I am going to tell a story to you. Listen carefully and when I get all through I want you to tell the story. Tell the story in the same order if you can. Do you understand? (Pause until student responds.) Now listen.

APPENDIX G

Raw Data

Raw Scores for Above-Average Boys on
Short-Term Auditory Memory Tests

Subject Number	Memory for Consonant Names	Memory for Words	Memory for Sentences	Memory for a Story
101	85	53	183	37
102	76	40	165	40
103	75	41	183	29
104	81	44	172	27
105	52	37	143	26
106	71	38	152	31
107	84	53	173	41
108	82	36	155	33
109	74	45	194	44
110	71	40	156	22
111	72	48	167	27
112	63	36	181	24
113	81	44	149	36
114	79	44	196	42
115	79	38	177	37
116	58	39	159	41

Raw Scores for Above-Average Girls on
Short-Term Auditory Memory Tests

Subject Number	Memory for Consonant Names	Memory for Words	Memory for Sentences	Memory for a Story
201	60	37	160	36
202	82	46	178	47
203	75	46	173	35
204	83	46	181	43
205	79	41	159	30
206	88	35	162	29
207	65	32	161	20
208	86	49	183	25
209	72	39	171	39
210	67	35	145	28
211	90	50	175	41
212	73	45	175	44
213	67	42	144	32
214	71	34	169	35
215	90	43	180	30
216	78	43	200	49

Raw Scores for Below-Average Boys on
Short-Term Auditory Memory Tests

Subject Number	Memory for Consonant Names	Memory for Words	Memory for Sentences	Memory for a Story
301	74	31	144	36
302	80	38	115	21
303	68	34	168	33
304	70	39	141	29
305	73	36	159	37
306	62	17	128	15
307	66	34	128	44
308	59	31	144	31
309	73	36	153	31
310	55	30	116	18
311	67	27	123	06
312	68	37	174	23
313	67	37	140	21
314	82	36	156	25
315	55	34	149	33
316	77	37	162	35

Raw Scores for Below-Average Girls on
Short-Term Auditory Memory Tests

Subject Number	Memory for Consonant Names	Memory for Words	Memory for Sentences	Memory for a Story
401	77	34	160	23
402	68	34	164	05
403	73	31	155	32
404	66	33	146	32
405	59	30	119	06
406	70	41	165	40
407	67	25	174	21
408	76	35	173	43
409	59	36	172	10
410	77	36	172	31
411	69	41	140	08
412	31	14	124	26
413	67	37	163	28
414	71	45	152	36